REMARKS

Applicants respectfully request reconsideration of this application as amended. Claims 1-42 remain in this application. Claims 1, 10, 16, 25, 31, and 37 have been amended. No new claims have been added.

Examiner Interview

Applicant thanks Examiner for the interview of November 21, 2005.

Rejections under 35 U.S.C. § 112

The Office Action rejected claims 1-9 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. Applicants have clarified claim 1.

Rejections under 35 U.S.C. § 103(a)

The Office Action rejected claims 1-3, 5, and 8 under 35 U.S.C. § 103(a) as being unpatentable over Golmie et al., "A Differentiated Optical Services Model for WDM Networks" (hereinafter "Golmie") in view of Sengupta et al., "Analysis of Enhanced OSPF for Routing Lights in Optical Mesh Networks" (hereinafter "Sengupta") and Tisue, "Notes for CS-311" (hereinafter "Tisue").

Applicants respectfully submit that the combination of Golmie and Sengupta does not describe what Applicants' claim 1 requires. Golmie discloses "a QoS service model in the optical domain ... based on a set of optical parameters that captures the quality and reliability of the optical lightpath." (Golmie, Abstract.) An optical lightpath being "an optical communication channel, traversing one or more optical links, between a source-destination pair." (Golmie, Page 69, Left column.) An optical resource allocater handles the dynamic provisioning of lightpaths..." (Golmie, Page 72, Left column.) Golmie does

not describe what type of databases are used, the content of these databases, or where a network topology database may be stored.

Sengupta discloses "enhancements to the OSPF protocol for routing and topology discovery in optical mesh networks." (Sengupta, Abstract.) "OSPF allows hierarchical routing, whereby a large network may be treated as a collection of smaller areas with limited information exchange between areas." (Sengupta, Page 2865, Right column.) "[R]oute computation is triggered by path setup requests only... [with the] need to run the path computation algorithm at an ingress OXC only when the lightpath request arrives." (Sengupta, Page 2866, Right column.) It is Applicants' understanding that in this system each node of an area has the same database that contains information about the all of the nodes of entire area and is not specific to just that particular node; route calculation is only responsive a lightpath request and no forwarding table is computed. (Sengupta, Page 2866, Right column, bullet 4.)

Tisue describes using brute force to determine the cheapest path in a graph. (Tisue, pages 3-4.) In this brute force method (a modified version of his depth-first traversal algorithm), all paths are tried, each path found is saved (presumably on a stack like the depth-first traversal algorithm), and the best path is picked. (Tisue, page 2-4.) Tisue does not describe determining what, if any, wavelengths are available and/or accessible to a node in the graph. Nor does Tisue describe maintaining a network topology of paths and wavelengths from an access node.

There is no motivation to combine Tisue with Sengupta. Tisue was known in Fall 2000 which was two years prior to Sengupta. Yet, Sengupta chose not to implement the brute force strategy of Tisue to find paths.

Furthermore, even if there was a motivation to combine, the combination does not describe what Applicants' claim 1 requires. Specifically, the combination does not describe:

> a plurality of wavelength division multiplexing access nodes of an optical network employing a source based scheme to establish communication paths, each of said plurality of access nodes <u>building and maintaining</u> a set of one or more network topology databases <u>specific to that access node</u> based on a set of one or more connectivity constraints, wherein network topology is the set of paths and wavelengths of possible communication paths from that access node to other nodes, and wherein the wavelengths for each path are the set of wavelengths of each link of that path that are available for establishing lightpaths on that path.

The combination of Golmie, Sengupta, and Tisue is an OSPF based system wherein each node of an area utilizes the <u>same</u> database about all of the nodes of the area that uses the brute force algorithm of Tisue to calculate "on-the-fly" path calculation. This database would not contain paths but rather the physical topology of the entire network. This is described by Sengupta because "route computation is triggered by path setup requests only... [with the] need to run the path computation algorithm at an ingress OXC only when the lightpath request arrives." In other words, paths would calculated on-the-fly by brute force when a path setup request is received and not stored in the database. This combination does not describe "each of said plurality of access nodes building and maintaining a set of one or more network topology databases specific to that access node based on a set of one or more connectivity constraints, wherein network topology is the set of paths and wavelengths of possible communication paths from that access node to other nodes." Rather, each node has the same database that contains information about the all of the nodes of entire area and is not specific to the node.

Accordingly, the combination of Golmie, Sengupta, and Tisue does not describe what Applicants' claim 1 requires. Claims 2-9 are dependent upon claim 1 and are allowable for at least the same reasons.

The Office Action rejected claims 10-11 and 14 under 35 U.S.C. § 103(a) as being unpatentable over Sengupta in view of Shami et al., "Performance Evaluation of Two GMPLS-Based Distributed Control and Management Protocols for Dynamic Lightpath Provisioning in Future IP Networks" (hereinafter "Shami").

The combination of Sengupta and Shami does not describe what Applicants' claim 10 requires. Specifically, the combination does not describe:

> a wavelength division multiplexing optical network
> including a plurality of access nodes each including,
> <u>for each link connected to the access node, a link channel set representing at least certain wavelengths on that link available for establishing a lightpath</u>, wherein a lightpath is a wavelength and a path, wherein <u>the path of a given lightpath is a series of two or more nodes and links interconnecting</u> them through which traffic is carried by the wavelength of that lightpath, wherein said series of nodes respectively starts and ends with a source node and a destination node, and
> <u>a database representing conversion free connectivity for the access node to others of said access nodes using the wavelengths in said link channel sets, wherein said conversion free connectivity includes the paths and wavelengths of possible lightpaths having the access node as the source node and others of the access nodes as the destination node.</u>

Shami discloses that "none of the OXCs has wavelength conversion capability…a lightpath that uses the same wavelength on all the links along the entire route from source-to-destination must be set up." (Shami, Page 2290, Left column.) Shami discloses two approaches to routing. In the first approach, "each node in the network is required to maintain a routing table that contains an ordered list of a number of fixed shortest routes to each destination node…[and] maintain[s] information regarding the

status of wavelength usage on its outgoing links." (Shami, Page 2290, Right column.) In this approach, "[w]hen a connection request arrives, the source node attempts to establish the connection on each of the routes maintained in the routing table in sequence, until a route with a valid wavelength assignment (first-fit algorithm) is found." (Shami, Page 2290, Right column.) Essentially, a message must traverse the entire route trying to find a wavelength (of the free wavelengths at the node) that will work. (Shami, Page 2291, Left column.) If two of such messages fail, then the connection is blocked. (Shami, Page 2291, Left column.) In the second approach, Shami discloses a modified OSPF setup. In this approach "each node in the network must maintain complete network state information, including the network topology and wavelength usage on each link." (Shami, Page 2291, Left column.) This network state information is identical for all nodes. (Shami, Page 2291, Right column.)

The combination of Sengupta and Shami could therefore describe one of two approaches. In the first approach, each node of an area maintains two things: 1) a routing table that contains "an ordered list of a number of fixed shortest routes"; and 2) information regarding that status of wavelength usage on its outgoing links (not information regarding lambdas on other links on those routes). This is clear from how Shami describes the process to setup a lightpath (a message must be sent to all nodes of the route to identify a final set of free wavelengths representing the intersection of the free wavelengths of each of the links on the route; the last hop router picks a free wavelength from the final set). This approach does not describe a "database representing conversion free connectivity for the access node to others of said access nodes using the wavelengths in said link channel sets, <u>wherein said conversion free connectivity includes the paths and wavelengths of possible lightpaths</u> having the access node as the source node and others of the access nodes as the destination node" because for a node only the "status of wavelength usage on its own outgoing links" is maintained and therefore, the

"wavelengths of possible lightpaths having the access node as the source node and others of the access nodes as the destination node" are not included in the database.

In the second approach, each node maintains complete network state information for its area. Thus, the combination of Shami and Sengupta is an OSPF based system wherein each node of an area utilizes the same database about all of the nodes of the area. Therefore, the combination does not describe each "access node" having a "database representing conversion free connectivity" "that is that is based on a set of one or more connectivity constraints, where conversion free connectivity includes the paths and wavelengths of possible lightpaths from that access node to other nodes."

Therefore, the combination of Shami and Sengupta does not describe what Applicants' claim 10 requires. Claims 11-15 are dependent upon claim 10 and are allowable for at least the same reason.

The Office Action rejected claims 16-19, 21-22, 24-26, 28, 30-34, and 36 under 35 U.S.C. § 103(a) as being unpatentable over Sengupta in view of Shami. With respect to claim 16, the combination of Sengupta and Shami does not describe what Applicants' claim requires. Specifically the combination does not describe

> each of a plurality of access nodes of a wave length division multiplexing optical network, tracking wavelengths for each link of the wave length division multiplexing optical network connected to that access node;
>
> each of said plurality of access nodes, maintaining a topology of that node based on conversion free connectivity to others of said plurality of said access nodes; and
>
> responsive to a request for a communication path received by any one of said plurality of access nodes, that access node,
>
> selecting both a path through a set of one or more links of said optical network and a single wavelength available on everyone of said set

of links based on said topology maintained in that access node, and
causing allocation of said selected path and wavelength.

In the first approach described by the combination of Sengupta and Shami, the "last hop-router (destination)" of a route picks one free wavelength from the final set if the final set is not empty. This is necessary because the routing table stored does not have sufficient information to allow for the source node to pick the path and wavelength. This does not describe or suggest "responsive to a request for a communication path received by any one of said plurality of access nodes, that access node, selecting both a path through a set of one or more links of said optical network and a single wavelength available on everyone of said set of links based on said topology maintained in that access node"; much less "maintaining a topology" for each node, the "topology based on conversion free connectivity" (and thus it is specific to that access node and different from other nodes) "to others of said plurality of network nodes."

In the second approach described by the combination of Sengupta and Shami, a full physical topology is stored in every node of an area and this physical topology is the same for every node. This does not describe or suggest the claim limitation of "each of said plurality of access nodes, maintaining a topology based on conversion free connectivity to others of said plurality of said access nodes, wherein the topology of each of said plurality of access nodes is different than others of said plurality of access nodes."

Accordingly, the combination of Sengupta and Shami does not describe what Applicants'' claim 16 requires. Claims 17-24 are dependent upon claim 16 and are allowable for at least the same rationale.

With respect to claim 25, the combination of Sengupta and Shami does not describe what Applicants' claim 25 requires. Specifically, the combination does not describe:

an access node, to be coupled in a wavelength division multiplexing optical network, including,

a link state database to store, for each link connected to said access node, a link state structure to store a port of the access node to which that link is connected and available wavelengths on that link,

a database to store a representation of available paths from the access node to others of said access nodes using the wavelengths in said link state database, wherein a path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths, wherein the database is different than other access nodes to be coupled in the wavelength division multiplexing optical network, and

a module to, responsive to requests for communication paths received by said access node, select from unallocated ones of said available paths and the common set of wavelengths thereon a selected path and wavelength.

In the first approach described by the combination of Sengupta and Shami, the "last hop-router (destination)" of a route picks one free wavelength from the final set if the final set is not empty. This is necessary because the routing table stored does not have sufficient information to allow for the source node to pick the path and wavelength. This does not describe or suggest "a module to, responsive to requests for communication paths received by said access node, select from unallocated ones of said available paths and the common set of wavelengths thereon a selected path and wavelength." Much less "a database to store a representation of available paths from the access node to others of said access nodes using the wavelengths in said link state database, wherein a path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths, wherein the database is different than other access nodes to be coupled in the wavelength division multiplexing optical network."

In the second approach described by the combination of Sengupta and Shami, a full physical topology is stored in every node of an area and this physical topology is the same for every node. This does not describe of suggest the claim limitation of each access node having "a database to store <u>a representation of available paths</u> from the access node to others of said access nodes <u>using the wavelengths in said link state database</u>, wherein a path is a series of two or more nodes connected by links on which <u>a common set of one or more wavelengths is available</u> for establishing one or more lightpaths, <u>wherein the database is different than other access nodes to be coupled in the wavelength division multiplexing optical network.</u>"

Claims 26-30 are dependent upon claim 25 and are allowable for at least the same rationale.

With respect to claim 31, the combination of Sengupta and Shami does not describe what Applicants' claim requires. Specifically, the combination does not describe

> receiving, at an access node of an wave division multiplexing optical network, demand criteria representing a request for a communication path;
> <u>selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network</u>, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths; and
> <u>said access node communicating with those of the access nodes on the selected path to cause allocation of the selected wavelength on the selected path.</u>

In the first approach described by the combination of Sengupta and Shami, the "last hop-router (destination)" of a route picks one free wavelength from the final set if the final set is not empty. This is necessary because the routing table stored does not

have sufficient information to allow for the source node to pick the path and wavelength. This does not described or suggest "selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths; and said access node communicating with those of the access nodes on the selected path to cause allocation of the selected wavelength on the selected path." For a node in this combination, only the "status of wavelength usage on its own outgoing links" is maintained and therefore, the "wavelengths from the access node to others of said access nodes in said optical network" are not included in the database.

In the second approach described by the combination of Sengupta and Shami, a full physical topology is stored in every node of an area, and this physical topology is the same for every node. This does not describe of suggest the claim limitation of each access node having "selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths."

Claims 32-36 are dependent upon claim 31 and are allowable for at least the same rationale.

The Office Action rejected claims 34-40 and 42 under 35 U.S.C. § 103(a) as being unpatentable over Sengupta and Shami as applied to claims 16-19, 21-22, 24-26, 28, 30-34, and 36 above, and further in view of Freeman, "Telecommunication System

Engineering" (hereinafter "Freeman"). Freeman discloses to store method steps as program memory for providing instructions to a controller or computer.

With respect to claim 37, the combination of Sengupta and Shami does not describe what Applicants' claim requires. Specifically, the combination does not describe

> receiving, at an access node of an wave division multiplexing optical network, demand criteria representing a request for a communication path;
> selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths; and
> said access node communicating with those of the access nodes on the selected path to cause allocation of the selected wavelength on the selected path.

In the first approach described by the combination of Sengupta and Shami, the "last hop-router (destination)" of a route picks one free wavelength from the final set if the final set is not empty. This is necessary because the routing table stored does not have sufficient information to allow for the source node to pick the path and wavelength. This does not described or suggest "selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths; and said access node communicating with those of the access nodes on the selected path to cause allocation of the selected wavelength on the selected path." For a node in this combination, only the "status of wavelength usage on its own

outgoing links" is maintained and therefore, the "wavelengths from the access node to others of said access nodes in said optical network" are not included in the database.

In the second approach described by the combination of Sengupta and Shami, a full physical topology is stored in every node of an area, and this physical topology is the same for every node. This does not describe of suggest the claim limitation of each access node having "selecting a path and a wavelength on said path using a database for that node that is stored in said access node and that stores a representation of available paths and wavelengths from the access node to others of said access nodes in said optical network, wherein each path is a series of two or more nodes connected by links on which a common set of one or more wavelengths is available for establishing one or more lightpaths."

Claims 38-42 are dependent upon claim 37 and are allowable for at least the same rationale.

Applicants respectfully submit that the claims are in condition for allowance.

Invitation for a telephone interview

The Examiner is invited to call the undersigned at 408-720-8300 if there remains any issue with allowance of this case.

Charge our Deposit Account

Please charge any shortage to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN

Date: February 24, 2006

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